PATENT ABSTRACTS OF JAPAN

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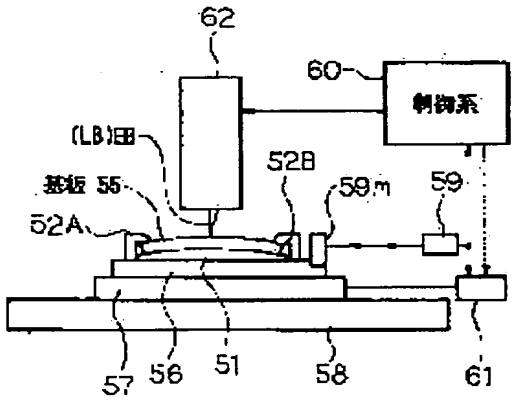
(54) PRODUCTION OF PHOTOMASK AND APPARATUS THEREFOR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a process for producing such a photomask which obviates a positional error of the projected image of the pattern of the photomask even when the photomask is deformed by its own weight, etc., at the time of use.

SOLUTION: A substrate 55 for the photomask is placed atop a substrate holder 51 having an upwardly projecting surface. This substrate holder 51 is fixed into a susceptor 56 and the surface of this susceptor 56 is provided with fixing pins 52A, 52B for downwardly energizing the parts near the opposite two sides of the substrate 55. After the position of the susceptor 56 is set by an X-Y stage 57, the prescribed original plate pattern is drawn on the substrate 55 by means of a writing system 62. The upward deformation quantity of the pattern surface of the substrate 55 is previously set the same as the downward deformation quantity of the pattern surface of the substrate 55 by its own weight of the photomask at the time of the produced photomask is used.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The manufacture approach of the photo mask characterized by doubling the deformation condition of said substrate with said deformation condition predicted in case the deformation condition of the substrate of said photo mask at the time of the imprint in said aligner is predicted and the pattern for an imprint is drawn or imprinted on said substrate in the manufacture approach of the photo mask used for the imprint in an aligner.
[Claim 2] The manufacture approach of the photo mask according to claim 1 characterized by sagging said substrate so that the forming face of the pattern for said imprint may turn into a convex.
[Claim 3] Claim 1 characterized by manufacturing the parent mask with which the pattern corresponding to the pattern for said imprint was formed, and carrying out projection exposure of the optical image of the pattern of said parent mask on the substrate of said photo mask, or the manufacture approach of a photo mask given in two.
[Claim 4] Claim 1 characterized by dividing into the pattern of two or more parent masks the pattern to which the pattern for said imprint was expanded, and carrying out the sequential imprint of the contraction image of the pattern of said two or more parent masks on the substrate of said photo mask, performing a screen splice, or the manufacture approach of a photo mask given in two.
[Claim 5] The manufacturing installation of the photo mask characterized by having the photo-mask attachment component which is made to deform the substrate of said photo mask into a predetermined condition, and holds it in the manufacturing installation of the photo mask used for the imprint in an aligner, and the pattern formation system which draws or imprints the pattern for an imprint on said substrate held at this photo-mask attachment component.
[Claim 6] Said photo-mask attachment component is the manufacturing installation of the photo mask according to claim 5 characterized by holding so that the pattern formation side of said substrate may turn into a convex to said pattern formation system.
[Claim 7] Said photo-mask attachment component is the manufacturing installation of the photo mask according to claim 6 with which the field in which said substrate is laid is characterized by having a cylinder side-like mounting member and the energization member which energizes near [where said substrate on this mounting member counters] the two sides to this mounting member side.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] In case this invention manufactures micro devices, such as a semiconductor integrated circuit, a liquid crystal display component, or the thin film magnetic head, using a lithography technique, it relates to the manufacture approach of a photo mask and equipment which are used as an original edition pattern.
[0002]
[Description of the Prior Art] In case devices, such as a semiconductor integrated circuit, are manufactured, the photo mask with which the original edition pattern which expanded the circuit pattern which should be formed to about 4 to 5 times was formed is used, and the imprint method which carries out contraction projection of the pattern of this photo mask on exposed substrates, such as a wafer or a glass plate, through contraction projection optics is used. An aligner is used in the case of the imprint of the pattern of such a photo mask, and the photo mask used with the contraction projection mold aligner of a step-and-repeat method is also called the reticle.
[0003] Conventionally, such a photo mask was manufactured by using an electron beam exposure system or laser beam drawing equipment on a predetermined substrate, and drawing an original edition pattern. That is, after forming a mask ingredient and applying a resist on the substrate, the original edition pattern is drawn using an electron beam exposure system or laser beam drawing equipment. Then, the original edition pattern was formed with the mask ingredient by developing the resist and performing etching processing etc. in this case, since the pattern which expanded the pattern of a device beta twice is sufficient as the original edition pattern drawn by that photo mask when the contraction scale factor of the aligner of the contraction projection mold which uses that photo mask is made into 1/beta twice, the drawing error by drawing equipment is reduced about 1/beta twice on a device. therefore, the pattern of a device can be substantially formed by twice [about 1/beta] as many resolving power as the resolving power by drawing equipment.
[0004] Moreover, in such drawing equipment, in case an original edition pattern is drawn on the substrate for photo masks, it is arranged almost evenly from the relation on arrangement with the stage device to which the substrate is held and moved, and the drawing system which consists of optical system or an electron optics system, so that the pattern side of the substrate may serve as "facing up."
[0005]
[Problem(s) to be Solved by the Invention] Like the above, conventionally, the original edition pattern of a photo mask is drawn by the electron beam exposure system or laser beam drawing equipment, and the pattern side of the substrate for photo masks is arranged upward almost evenly at the time of drawing. On the other hand, from the relation on arrangement with the stage device to which an exposed substrate is held and moved, and projection optics, when the manufactured photo mask is used with the aligner which performs exposure to exposed substrates, such as a wafer, it is arranged so that the pattern side of the substrate of a photo mask may serve as "facing down." Moreover, the original edition pattern which should be imprinted is formed in the core of a photo mask, and since this part cannot be held, maintenance of a photo mask is performed in the form supporting the periphery of that substrate. For this reason, as for a photo mask, in the condition of being used with an aligner, it is common to be used, where self-weight deformation is carried out so

that it may become a convex in the direction of a pattern side.
[0006] Thus, in the photo mask which carried out self-weight deformation, the pattern side which deformed into the convex in connection with deformation will deform in the direction in which the location of elongation and an original edition pattern is expanded slightly. As above-mentioned, on the other hand, with the drawing equipment of the conventional photo mask Since having been arranged evenly was common so that the pattern side of the substrate at the time of drawing of an original edition pattern might turn to the upper part The self-weight deformation at the time of drawing having un-arranged [that the location precision of the projection image of an original edition pattern will fall], when the self-weight deformation at the time of use (pattern facing down) became large and actually used a photo mask in connection with it to there being nothing not much. Although it is mostly settled in tolerance in the present condition, it has a possibility that the location precision may stop settling in tolerance as the degree of integration of the pattern to be imprinted from now on and whenever [the amount's of such a location precision of falls / detailed], improve further.
[0007] Moreover, although manufacturing the original edition pattern of a photo mask by imprinting a predetermined pattern using a projection aligner is also considered, when the pattern side of the substrate of that photo mask is evenly held upward in a projection aligner also in this case, there is a possibility that the position error of a projection image etc. may arise, at the time of actual use. In case this invention uses a photo mask in view of this point, even if it is the case where self-weight deformation etc. arises, it aims at offering the manufacture approach of a photo mask that the location precision of the projection image of the photo mask is maintainable good.
[0008] Moreover, this invention aims also at offering the manufacturing installation which can enforce the manufacture approach of such a photo mask.
[0009]
[Means for Solving the Problem] The manufacture approach of the photo mask by this invention predicts the deformation condition of the substrate (4) of the photo mask at the time of the imprint in the aligner, and in case it draws or imprints the pattern for an imprint on the substrate (4), it doubles the deformation condition of the substrate with the deformation condition predicted in the manufacture approach of the photo mask (34) used for the imprint in an aligner.
[0010] According to this this invention, since the deformation of the substrate at the time of drawing of a up to [the substrate for the photo masks at the time of manufacturing a photo mask] or projection has agreed with deformation, such as self-weight deformation of the substrate when exposing using the photo mask, even if it deforms the substrate at the time of use of the photo mask, it does not have the fall of the location precision of a projection image.
[0011] In this case, it is desirable to sag that substrate (4) so that the forming face of the pattern for that imprint may turn into a convex. When using a photo mask with the usual aligner, the substrate of the photo mask is supported so that the pattern side may turn into a convex, in order to carry out self-weight deformation downward. Therefore, the location precision of the projection image at the time of using the photo mask becomes small.
[0012] Moreover, the parent mask with which the pattern corresponding to the pattern for the imprint (27) was formed is manufactured, and it may be made to carry out projection exposure of the optical image of the pattern of the parent mask on the substrate (4) of the photo mask. Even when carrying out projection exposure of the optical image, the location precision at the time of use improves by doubling the deformation condition of the substrate (4) at the time of use.
[0013] Moreover, the pattern (36) to which the pattern for the imprint (27) was expanded is divided into the pattern of two or more parent masks (R1-RN), and it is desirable to carry out the sequential imprint of the contraction image of the pattern of the two or more parent masks on the substrate (4) of the photo mask, performing a screen splice. In this case, as an example, the thin film of a mask ingredient is formed on the substrate (4) of that photo mask, and sensitive material, such as a photoresist, is applied on this. Then, on the sensitive material, it is optical, and after the contraction image of the pattern of two or more parent masks is imprinted using the aligner of a contraction projection mold by step-and-repeat method or step - and - scanning method, development of the sensitive material is performed, for example. And the pattern for a desired imprint (original edition pattern) is formed by performing etching etc. by using the pattern of the left-behind sensitive

material as a mask.
[0014] under the present circumstances, if it is alike and the contraction scale factor of an aligner optical [for that photo-mask manufacture] is made into 1/alpha twice (alpha is a larger integer than 1, a half-integer, etc.), it will be expanded alpha twice, the pattern (27), i.e., the original edition pattern, for that imprint, and this expanded parent pattern (36) will be divided into the pattern of the parent mask of alphaxalpha ** in all directions. If it is 1/5 time (alpha= 5) the contraction scale factor of this, 25 parent masks will be prepared by 5x5 times. since [consequently,] the pattern formed in each parent mask turns into some parent patterns which expanded the original edition pattern alpha twice -- 1 of the former [amount of data / of the pattern of each parent mask / drawing]/alpha 2 Decreasing to extent, minimum line width becomes twice [alpha] over the past. Therefore, the pattern of each parent mask can be drawn with high precision by few drifts in a short time, for example using a conventional electron beam exposure system or laser beam drawing equipment, respectively. Moreover, in order that the drawing error by drawing equipment may decrease to 1/alpha on the photo mask, the precision of an original edition pattern improves more. Furthermore, since the pattern of those parent masks can be imprinted at a high speed on the substrate of the photo mask by a step-and-repeat method etc. once manufacturing those parent masks, the production time in the case of manufacturing two or more sheets of especially the photo mask can be separately shortened sharply compared with the method which draws with drawing equipment like before.
[0015] Moreover, in case the sequential imprint of the contraction image of the pattern of two or more parent masks (R1-RN) is carried out on the front face of the substrate (4), it is desirable to amend the image formation properties (an imprint location, a scale factor, distortion, etc.) of the contraction image of the pattern of the parent mask (R1-RN) at least according to one side of the nonrotation symmetry aberration of the projection optics (42) of a projection aligner and the distortion property which use the photo mask, respectively.
[0016] thus, when the amount of fluctuation of the predetermined image formation property of the aligner which uses the photo mask is known beforehand In case the pattern image of each parent mask is imprinted performing a screen splice on the substrate of the photo mask, so that the amount of fluctuation of the image formation property may be offset by the imprint location of the pattern image of each parent mask, the scale factor, and adjusting distortion etc. further Distortion of the device pattern finally exposed using the photo mask etc. becomes small, and superposition precision etc. improves.
[0017] About this, several many sheets of the photo mask may be manufactured, and these photo masks may be used by two or more sets of projection aligners by a mix and match method etc. In this case, it is desirable to adjust an imprint location, the characteristic of image, etc. at the time of connecting and imprinting the pattern of each parent mask according to average properties, such as the distortion property of the projection image of at least two sets of the projection aligners which are due to use those photoresists, so that a good superposition precision may be acquired with each projection aligner.
[0018] Next, as for the photo mask, being further used by contraction projection is desirable. the photo mask as what is used by contraction projection of for example, 1/beta twice (beta is a larger integer than 1 or a half-integer) in the contraction scale factor of the aligner for manufacturing the photo mask, supposing it is 1/alpha twice (alpha is a larger integer than 1 or a half-integer like beta), the drawing error of the pattern of each parent mask will be reduced 1-/(alpha-beta) twice on the device pattern finally exposed. Therefore, also when setting minimum line width of a device pattern to current one half temporarily, an electron beam exposure system or laser beam drawing equipment is used, and the pattern of each parent mask can be easily drawn in a required precision in a short time. Therefore, even if a pattern rule makes it detailed further, a desired device pattern can be exposed in a required precision.
[0019] Next, the manufacturing installation of the photo mask by this invention In the manufacturing installation of the photo mask (34) used for the imprint in an aligner The photo-mask attachment component which is made to deform the substrate (4) of the photo mask into a predetermined condition, and holds it (51, 52A, 52B), It has the pattern formation system (1, 2, 3; 62) which draws or imprints the pattern for an imprint on the substrate (4) held at this photo-mask attachment

component. By using the manufacturing installation of this photo mask, the manufacture approach of the photo mask of this invention can be enforced.
[0020] In this case, that photo-mask attachment component has desirable ** held so that the pattern formation side of that substrate (4) may turn into a convex to that pattern formation system. It can respond to the anticipated-use condition of a photo mask now. Moreover, as for that photo-mask attachment component, the field in which that substrate (4) is laid has as an example a cylinder side-like mounting member (51) and the energization member (52A, 52B) which energizes near [where that substrate on this mounting member (4) counters] the two sides to this mounting member side. By this, the pattern formation side of the substrate can be held in a convex.
[0021]
[Embodiment of the Invention] Hereafter, with reference to a drawing, it explains per example of the gestalt of operation of this invention. Drawing 1 is drawing showing the production process of the photo mask of this example, and the photo mask made applicable to manufacture by this example is the working reticle 34 used in case a semiconductor device is actually manufactured in drawing 1 . the whole surface of the substrate of light transmission nature with which this working reticle 34 consists of quartz glass etc. -- chromium (Cr) and silicification -- the original edition pattern 27 for an imprint is formed from molybdenum (MoSi2 etc.) or other mask ingredients. Moreover, two alignment marks 24A and 24B are formed so that the original edition pattern 27 may be inserted.
[0022] furthermore, the working reticle 34 is used through the projection optics of an optical projection aligner by contraction projection of 1 / beta twice (beta is a larger integer than 1 or a half-integer, and is 4, 5, or 6 grades as an example). that is, in drawing 1 , after exposing to each shot field 48 on the wafer W with which contraction image 27W 1 / twice [beta] as many as the original edition pattern 27 of the working reticle 34 were applied to the photoresist, the predetermined circuit pattern 35 is formed in each of that shot field 48 by performing development, etching, etc. Moreover, in this example, image formation properties, such as nonrotation symmetry aberration of the projection image of that projection aligner and a distortion property, are measured beforehand, and this measurement result is used at the time of manufacture of that working reticle 34. Furthermore, in this example, the forecast of the deformation by the self-weight of the working reticle 34 at the time of laying the working reticle 34 in the projection aligner is calculated, and like the after-mentioned, at the time of manufacture of the working reticle 34, the substrate for the working reticle 34 deforms into same extent as the forecast, and is laid. Hereafter, it explains per example of the manufacture approach of the working reticle 34 as a photo mask of this example.
[0023] In drawing 1 , the circuit pattern 35 of a certain layer of the semiconductor device finally manufactured first is designed. The circuit pattern 35 forms Rhine [of the versatility / width of face / of the side which intersects perpendicularly / in the field of the rectangle of dX and dY] -, - tooth-space pattern, etc. this example -- the circuit pattern 35 -- beta twice -- the original edition pattern 27 with which it carries out and the width of face of the side which intersects perpendicularly consists of a field of the rectangle of beta-dX and beta-dY is created on the image data of a computer. beta twice are the inverse number of the contraction scale factor (1/beta) of the projection aligner with which the working reticle 34 is used. In addition, when reversal projection is carried out, it is reversed and has expanded.
[0024] It carries out. next, the original edition pattern 27 -- alpha twice (alpha is a larger integer than 1 or a half-integer, and is 4, 5, or 6 grades as an example) -- The parent pattern 36 which consists of a field of the rectangle of alpha-beta-dX and alpha-beta-dY is created on image data, and the width of face of the side which intersects perpendicularly divides the parent pattern 36 into alpha individual in all directions, respectively, and creates the parent patterns P1, P2, P3, --, PN (N=alpha 2) of an alphaxalpha individual on image data. The case of alpha= 5 is shown by drawing 1 . In addition, the need of making the scale factor alpha from the original edition pattern 27 to the parent pattern 36 not necessarily agreeing does not have the number of partitions alpha of this parent pattern 36. Then, from those parent patterns Pi (i= 1 - N), the drawing data for electron beam exposure systems (or laser beam drawing equipment etc. can be used) are generated, respectively, and the parent pattern Pi is imprinted on the master reticle Ri as a parent mask by actual size, respectively.
[0025] the time of manufacturing the master reticle R1 of the 1st sheet -- the substrate top of light transmission nature, such as quartz glass, -- chromium or silicification -- after forming the thin film

of mask ingredients, such as molybdenum, and applying an electron beam resist on this, the actual size image of the 1st parent pattern P1 is drawn on that electron beam resist using an electron beam exposure system. Then, after developing an electron beam resist, the parent pattern P1 is formed in the pattern space 20 on the master reticle R1 by performing etching, resist exfoliation, etc. In this case, on the master reticle R1, the alignment marks 21A and 21B which consist of two two-dimensional marks by position relation to the parent pattern P1 are formed. Similarly, an electron beam exposure system etc. is used for other master reticles Ri, and the parent pattern Pi and the alignment marks 21A and 21B are formed in them, respectively. It is used for the alignment at the time of these alignment marks 21A and 21B performing a screen splice behind.

[0026] thus, the case where the amount of each drawing data carries out direct writing of the original edition pattern 27 in this example since each parent pattern Pi which draws with an electron beam exposure system (or laser beam drawing equipment) is a pattern which expanded the original edition pattern 27 alpha twice -- comparing -- 1/alpha 2 It is decreasing to extent. since [furthermore,] it is twice [alpha] (for example, 5 times or 4 times) the minimum line width of the parent pattern Pi of this compared with the minimum line width of the original edition pattern 27 -- the electron beam resist of the former [pattern / Pi / each / parent] respectively -- using -- an electron beam exposure system -- a short time -- and it can draw with high precision. Moreover, since the rest can manufacture the working reticle 34 of required number of sheets by repeating and using them like the after-mentioned once it manufactures the master reticles R1-RN of N sheets, the time amount for manufacturing the master reticles R1-RN is not a big burden.

[0027] that is, the working reticle 34 is manufactured by imprinting the twice [1/alpha] as many contraction image PIi (i= 1 - N) as the parent pattern Pi of the master reticle Ri of these N sheets, performing a screen splice, respectively. In addition, in order to reduce the drawing error in an electron beam exposure system etc. according to the equalization effectiveness, the parent pattern which divided the parent pattern 36 of drawing 1 is drawn to 2 sets of master reticles of two or more sheets, and you may make it expose the contraction image of the pattern of these 2 sets of master reticle groups in piles on the substrate 4 for working reticle 34.

[0028] Drawing 2 shows the optical contraction projection mold aligner used in case that working reticle 34 is manufactured, and the exposure light IL is irradiated in this drawing 2 by the reticle on a reticle stage 2 from the illumination-light study system 1 which consists of a fly eye lens, an illumination system aperture diaphragm, a reticle blind (adjustable field diaphragm), a condensing lens system, etc. for the exposure light source and illuminance distribution equalization at the time of exposure. On the reticle stage 2 of this example, the i-th master reticle (i= 1 - N) Ri is laid. In addition, as an exposure light, the excimer laser (wavelength of 157nm) light of the bright lines, such as i line (wavelength of 365nm) of a mercury lamp, KrF (wavelength of 248nm) and ArF (wavelength of 193nm), F2, etc. can be used.

[0029] Through projection optics 3, the image of the pattern in the lighting field of the master reticle Ri is contraction scale-factor 1/alpha (alpha is 5 or 4 grades), and is projected on the front face of the substrate 4 for working reticle 34. the substrate of light transmission nature [like quartz glass] whose substrate 4 is -- it is -- the pattern space 25 (refer to drawing 4) of that front face -- chromium or silicification -- the thin film of mask ingredients, such as molybdenum, is formed and the alignment marks 24A and 24B which consist of two two-dimensional marks for alignment so that this pattern space 25 may be inserted are formed. Moreover, the photoresist is applied so that a mask ingredient may be covered on the front face of a substrate 4. The Z-axis is taken in parallel with the optical axis AX of projection optics 3 hereafter, in a flat surface perpendicular to the Z-axis, in parallel with the space of drawing 2 , at right angles to the space of drawing 2 , a Y-axis is taken and the X-axis is explained.

[0030] First, a reticle stage 2 positions the master reticle Ri on this in XY flat surface. The location of a reticle stage 2 is measured by the non-illustrated laser interferometer, and actuation of a reticle stage 2 is controlled by this measurement value and control information from the main control system 9. On the other hand, a substrate 4 is held by vacuum adsorption on a non-illustrated substrate holder, this substrate holder is fixed on the sample base 5, and the sample base 5 is being fixed on X-Y stage 6. The sample base 5 doubles the front face of a substrate 4 with the image surface of projection optics 3 by controlling the focal location (location of the optical-axis AX

direction) of a substrate 4, and a tilt angle by the automatic focus method. Moreover, X-Y stage 6 positions the sample base 5 (substrate 4) in the direction of X, and the direction of Y with a linear motor system on the base 7.

[0031] By 8m of migration mirrors fixed to the upper part of the sample base 5, and the laser interferometer 8 countered and arranged, the X coordinate of the sample base 5, Y coordinate, and an angle of rotation are measured, and this measurement value is supplied to the stage control system 10 and the main control system 9. 8m of migration mirrors names generically migration mirror 8mX of the X-axis, and migration mirror 8mY of a Y-axis, as shown in drawing 3 . A stage control system 10 controls actuation of the linear motor of X-Y stage 6 etc. based on the measurement value and the control information from the main control system 9.

[0032] Moreover, in this example, the ledged reticle library 16 is arranged in the side of a reticle stage 2, and the master reticles R1, R2, --, RN are laid on the support plate 17 of N individual by which the sequential array was carried out into the reticle library 16 at the Z direction. These master reticles R1-RN are reticles (parent mask) in which the parent patterns P1-PN which divided the parent pattern 36 of drawing 1 , respectively were formed. The reticle library 16 is supported free [migration to a Z direction] by slide equipment 18, and the reticle loader 19 equipped with the arm which can rotate freely between a reticle stage 2 and the reticle library 16, and can move to it in the predetermined range at a Z direction is arranged. After the main control system 9 adjusts the location of the Z direction of the reticle library 16 through slide equipment 18, actuation of a reticle loader 19 is controlled, and it is constituted so that the desired master reticles R1-RN can be delivered between the support plate 17 of the request in the reticle library 16, and a reticle stage 2. In drawing 2 , the i-th master reticle Ri in the reticle library 16 is laid on the reticle stage 2.

[0033] Moreover, the stores 11, such as a magnetic disk drive, are connected to the main control system 9, and the exposure data file is stored in the store 11. The data of the image formation property of the projection image (projection optics) of the projection aligner which uses the working reticle manufactured by the physical relationship, the mutual alignment information, and this mutual example of the master reticles R1-RN etc. are recorded on the exposure data file.

[0034] Here, with reference to drawing 5 , it explains to a detail per maintenance approach of the substrate 4 on the sample base 5. Drawing 5 (B) shows the configuration of the attachment component on the sample base 5 of drawing 2 , in this drawing 5 (B), the substrate holder 51 with which the top face was made into the convex of the shape of a cylindrical side face is fixed on the sample base 5, and the substrate 4 is laid on that convex. Moreover, lock-pins 52A and 52B are formed on the sample base 5 so that the fields E1 and E2 near [which sandwiches the pattern space 25 of the pattern side (here top face) of a substrate 4 in the direction of X] the two sides may be energized to the substrate holder 5 side. By this, the pattern space 25 of the substrate 4 for working reticle 34 is deforming into "it is convex."

[0035] That is, as shown in drawing 5 (A) which is the top view of drawing 5 (B), in the field 53 near [parallel to the Y-axis between 1 set of sides where the direction of X of the substrate 4 which is a rectangular plate counters] the center line, as for a substrate 4, the pattern side is pushed on the upper part from a base side, and the pattern side is forced on the base side from the upper part in the fields E1 and E2 near the two sides of the both ends distant from the field 53. Thus, with reference to drawing 6 - drawing 8 , it explains per [holding a substrate 4] advantage.

[0036] The working reticle 34 which forms an original edition pattern on a substrate 4, and is manufactured by this example is laid on the reticle stage 49 of the projection aligner of drawing 6 , and the contraction image by the projection optics 42 of the original edition pattern 27 of the working reticle 34 is projected on Wafer W. In this case, as for the working reticle 34, the field near the two sides of the direction of X is held by vacuum adsorption on the reticle stage 49. Therefore, as shown in drawing 7 , the pattern side (inferior surface of tongue) in which the original edition pattern 27 of the substrate 4 of the working reticle 34 is formed is deforming into the bottom (projection optics 42 side) with the self-weight of a substrate 4 at the convex. By this, the original edition pattern 27 is deforming so that it may elongate.

[0037] That is, predetermined pattern 54A shall exist in the location of distance x1 from a core in the condition that there is no deformation in the working reticle 34 (substrate 4) as shown in drawing 8 (A). As shown in drawing 8 (B), supposing that pattern side deforms into "it is convex" according to

self-weight deformation of the working reticle 34 at this time, tension works in respect of the pattern of the working reticle 34, in respect of the distance between each part in the original edition pattern 27 being opposite to elongation and it (top face), a pressure will be added and the distance for two points will be shrunken. And it is on longitudinal-plane-of-symmetry 4C of the thickness direction of the substrate 4 of the working reticle 34 that these amounts of telescopic motion balance.
[0038] Therefore, the location of the above-mentioned predetermined pattern 54A will transform only delta x in the direction which separates from a core, it will move to location 54B, and the distance from a core will spread in x2. The amount delta x of displacement will become the position error of the contraction image in the case of using the working reticle 34 as it is. however, in this example, since the deformation same to the substrate 4 as the time of use is given also at the time of the exposure to the substrate 4 for the working reticle 34 as shown in drawing 5 , the physical relationship of a pattern with the time of manufacture and use is maintained -- having -- the time of use (at the time of the imprint to a wafer) -- the location of a pattern -- a variation rate does not pose a problem
[0039] And after exposure of the contraction image of the 1st master reticle R1 to the 1st shot field on a substrate 4 is completed to drawing 2 at the time of the exposure to the substrate 4 of the example of return and a book, the next shot field on a substrate 4 moves to the exposure field of projection optics 3 by step migration of X-Y stage 6. In parallel to this, the master reticle R1 on a reticle stage 2 is returned to the reticle library 16 through a reticle loader 19, and the master reticle R2 for [of a degree] an imprint is laid on a reticle stage 2 through a reticle loader 19 from the reticle library 16. And after alignment is performed, projection exposure of the contraction image of the master reticle R2 is carried out to the shot field concerned on a substrate 4 through projection optics 3, and exposure of the contraction image of the master reticles R2-RN which carries out sequential correspondence to the remaining shot fields on a substrate 4 by the step-and-repeat method below is performed.
[0040] In addition, although the projection aligner of drawing 2 is an one-shot exposure mold instead, the contraction projection mold aligner of a scan exposure mold like step - and - scanning method may be used. In a scan exposure mold, the synchronous scan of a master reticle and the substrate 4 is carried out by the contraction scale-factor ratio to projection optics 3 at the time of exposure. By using the aligner of a scan exposure mold, errors (skew error etc.) with difficult amendment may also be able to be amended in an one-shot exposure mold like the after-mentioned.
[0041] Now, in case the contraction image of the master reticles R1-RN is exposed on a substrate 4 in this way, it is necessary to perform the screen splice between adjoining contraction images (connecting) with high precision. For that, it is necessary to perform alignment of each master reticle Ri (i= 1 - N) and the shot field (referred to as Si) where it corresponds on a substrate 4 with high precision. The projection aligner of this example is equipped with the reticle and the alignment device for substrates for this alignment.
[0042] Drawing 3 shows the alignment device of the reticle of this example, the reference mark member 12 of light transmission nature is fixed near the substrate 4 on the sample base 5 in this drawing 3 , and one pair of reference marks 13A and 13B of a cross-joint mold are formed at intervals of predetermined in the direction of X on the reference mark member 12. Moreover, the illumination system which illuminates reference marks 13A and 13B is installed in the projection optics 3 side by the pars basilaris ossis occipitalis of reference marks 13A and 13B by the illumination light which branched from the exposure light IL. At the time of the alignment of the master reticle Ri, by driving X-Y stage 6 of drawing 2 , as shown in drawing 3 , reference marks 13A and 13B are positioned so that the core of the reference marks 13A and 13B on the reference mark member 12 may agree in the optical axis AX of projection optics 13 mostly.
[0043] Moreover, two alignment marks 21A and 21B of a cross-joint mold are formed as an example so that the pattern space 20 of the pattern side (inferior surface of tongue) of the master reticle Ri may be inserted in the direction of X. It is in the condition of spacing of reference marks 13A and 13B being set up almost equally to spacing of the contraction image by the projection optics 3 of the alignment marks 21A and 21B, and having made the core of reference marks 13A and 13B agreeing in an optical axis AX mostly as mentioned above. By illuminating by the illumination light of the same wavelength as the exposure light IL from the base side of the reference mark member 12, the

expansion image by the projection optics 3 of reference marks 13A and 13B is formed near the alignment marks 21A and 21B of the master reticle Ri, respectively.
[0044] The mirrors 22A and 22B for reflecting the illumination light from a projection optics 3 side in the **X direction above these alignment marks 21A and 21B are arranged, and it has the alignment sensors 14A and 14B of an image-processing method by the TTR (through THE reticle) method so that the illumination light reflected by Mirrors 22A and 22B may be received. The alignment sensors 14A and 14B are equipped with an image formation system and two-dimensional image sensors, such as a CCD camera, respectively, the image sensor picturizes the image of the alignment marks 21A and 21B and the corresponding reference marks 13A and 13B, and the image pick-up signal is supplied to the alignment signal-processing system 15 of drawing 2 .
[0045] The alignment signal-processing system 15 carries out the image processing of the image pick-up signal, calculates the amount of location gaps to the direction of X of the alignment marks 21A and 21B to the image of reference marks 13A and 13B, and the direction of Y, and supplies these 2 sets of amounts of location gaps to the main control system 9. The main control system 37 positions a reticle stage 2 so that 2 sets of the amounts of location gaps may fall within a predetermined range mutually symmetrically and, respectively. The parent pattern Pi (refer to drawing 1) in the pattern space 20 of the alignment marks 21A and 21B, as a result the master reticle Ri is positioned to reference marks 13A and 13B by this.
[0046] In other words, the core (exposure core) of the contraction image by the projection optics 3 of the parent pattern Pi of the master reticle Ri is positioned substantially at the core (almost optical axis AX) of reference marks 13A and 13B, and the side where the profile (profile of a pattern space 20) of the parent pattern Pi intersects perpendicularly is set up in parallel with the X-axis and a Y-axis, respectively. In this condition, the main control system 9 of drawing 2 is memorizing the coordinate (XF0 and YF0) of the direction of X of the sample base 5 measured by the laser interferometer 8, and the direction of Y, and the alignment of the master reticle Ri ends it. After this, focusing on exposure of the parent pattern Pi, the point of the arbitration on the sample base 5 is movable.
[0047] Moreover, in drawing 2 , in order to carry out location detection of the mark on a substrate 4 to the side face of projection optics PL, it also has the alignment sensor 23 of an image-processing method by the off-axis method. The alignment sensor 23 illuminates a **-ed mark by the illumination light of a broadband with nonphotosensitivity to a photoresist, picturizes the image of a **-ed mark with two-dimensional image sensors, such as a CCD camera, and supplies an image pick-up signal to the alignment signal-processing system 15. In addition, spacing (the amount of base lines) of the detection core of the alignment sensor 23 and the core (exposure core) of the projection image of the pattern of the master reticle Ri is beforehand called for using the predetermined reference mark on the reference mark member 12, and is memorized in the main control system 9.
[0048] As shown in drawing 3 , two alignment marks 24A and 24B of a cross-joint mold are formed in the edge of the direction of X on a substrate 4. And after the alignment of the master reticle Ri is completed, by driving X-Y stage 6, the reference marks 13A and 13B of drawing 3 and the alignment marks 24A and 24B on a substrate 4 are moved to the detection field of the alignment sensor 23 of drawing 2 one by one, and the amount of location gaps to the detection core of the alignment sensor 23 of reference marks 13A and 13B and the alignment marks 24A and 24B is measured, respectively. These measurement results are supplied to the main control system 9, and these measurement results are used. The main control system 9 The coordinate of the sample base 5 in case the core of reference marks 13A and 13B agrees focusing on detection of the alignment sensor 23 (XP0 and YP0), And the coordinate (XP1, YP1) of the sample base 5 in case the core of the alignment marks 24A and 24B agrees focusing on detection of the alignment sensor 23 is searched for. The alignment of a substrate 4 is completed by this.
[0049] Consequently, spacing of the direction of X of the core of reference marks 13A and 13B and the core of the alignment marks 24A and 24B and the direction of Y serves as (XP0-XP1 and YP0-YP1). To the coordinate (XF0 and YF0) of the sample base 5 at the time of the alignment of the master reticle Ri then, by driving X-Y stage 6 of drawing 2 by the spacing (XP0-XP1 and YP0-YP1) The core (core of a substrate 4) of the alignment marks 24A and 24B of a substrate 4 can be made to agree with high precision at the core (exposure core) of the projection image of the alignment marks

21A and 21B of the master reticle Ri, as shown in drawing 4 . The contraction image PIi of the parent pattern Pi of the master reticle Ri can be exposed in a desired location to the core on a substrate 4 by driving X-Y stage 6 of drawing 2 , and moving in the direction of X, and the direction of Y from this condition, in the sample base 5.

[0050] That is, drawing 4 shows the condition of carrying out the contraction imprint of the parent pattern Pi of the i-th master reticle Ri on a substrate 4 through projection optics 3, and the pattern space 25 of the rectangle surrounded in the side parallel to the X-axis and a Y-axis centering on the core of the alignment marks 24A and 24B of the front face of a substrate 4 is virtually set up within the main control system 9 in this drawing 4 . the magnitude of a pattern space 25 is the magnitude which reduced the parent pattern 36 of drawing 1 1 / alpha twice, a pattern space 25 is equally divided into alpha individual in the direction of X, and the direction of Y, respectively, and the shot fields S1, S2, S3, --, SN (N=alpha 2) are set up virtually. The location of the shot field Si (i= 1 - N) is set as the location of the contraction image PIi of the i-th parent pattern Pi at the time of carrying out contraction projection of the parent pattern 36 of drawing 1 through the projection optics 3 of drawing 4 temporarily.

[0051] And when the image formation property of the projection image of the projection aligner which uses the working reticle 34 of this example is ideal, the main control system 9 is doubled in drawing 4 by driving X-Y stage 6 of drawing 2 focusing on exposure of the contraction image PIi of the parent pattern Pi of the master reticle Ri currently asked for the core of the i-th shot field Si on a substrate 4 by the above-mentioned alignment. Then, the main control system 9 makes luminescence of the exposure light source in the illumination-light study system 1 of drawing 2 start, and exposes the contraction image of the parent pattern Pi to the shot field Si on a substrate 4. In drawing 4 , the contraction image of the parent pattern already exposed within the pattern space 25 of a substrate 4 is shown by the continuous line, and the unexposed contraction image is shown by the dotted line.

[0052] Thus, it means that the contraction image of each parent patterns P1-PN was exposed by exposing the contraction image of the parent patterns P1-PN of the master reticles R1-RN of N individual of drawing 2 to the shot fields S1-SN to which it corresponds on a substrate 4 one by one, performing the contraction image and screen splice of a parent pattern which adjoin, respectively. the projection image 26 which reduced the parent pattern 36 of drawing 1 by 1 / alpha twice on the substrate 4 is exposed by this. Then, by developing the photoresist on a substrate 4 and performing etching, exfoliation of a resist pattern which remains, the projection image 26 on a substrate 4 serves as the original edition pattern 27 as shown in drawing 7 , and the working reticle 34 completes it.

[0053] By the way, on the occasion of exposure of one substrate 4, it is not concerned with exchange of the master reticle Ri, but the substrate 4 is ****(ed) on the sample base 5, and the location is correctly measured by the laser interferometer 8. Therefore, since the physical relationship of reference marks 13A and 13B and a substrate 4 does not change during exposure of one substrate 4, it is not necessary to necessarily detect the location of the alignment marks 24A and 24B on a substrate 4 for every master reticle Ri of one sheet that what is necessary is just to carry out alignment of the master reticle Ri to reference marks 13A and 13B at the time of exchange of the master reticle Ri. Also in this case, the parent pattern Pi on each master reticle Ri maintains exact physical relationship mutually, and is exposed by the alignment of each and reference marks 13A and 13B, and the position control of X-Y stage 6 by the stage control system 10 by which the monitor was carried out with the laser interferometer 8. Therefore, it cannot be overemphasized that it becomes highly precise [the splice precision between each of that pattern].

[0054] In addition, it is not necessary to necessarily form the alignment marks 24A and 24B beforehand on a substrate 4. in this case, in case the parent pattern of the master reticle Ri is connected on a substrate 4 as mentioned above and a contraction imprint is carried out The contraction imprint also of the predetermined mark on each master reticle Ri (for example, alignment marks 21A and 21B) is carried out. In case the contraction image of the parent pattern of an adjoining master reticle is imprinted, the location of the latent image of that mark is detected, and it may be made to amend the imprint location of the contraction image of the parent pattern of that adjoining master reticle from this detection result.

[0055] Moreover, when for example, the high density pattern and the isolated pattern are formed in the original edition pattern 27 of drawing 1 , only a high density pattern may be formed in the master

reticle Ra of one sheet in the master reticle R1 - RN, and only an isolated pattern may be formed in another master reticle Rb of one sheet. Since exposure conditions, such as best lighting conditions, image formation conditions, etc., differ by the high density pattern and the isolated pattern at this time, you may make it optimize exposure conditions, i.e., the configuration of the aperture diaphragm in the illumination-light study system 1 and magnitude, a coherence factor (sigma value), the numerical aperture of projection optics 3, etc. according to that parent pattern Pi for every exposure of the master reticle Ri. Moreover, in order to optimize the exposure condition, it may insert [light filter / (the so-called pupil filter) / predetermined] near the pupil surface of projection optics 3, or the so-called progressive focal method (FREX law) which vibrates relatively the image surface of projection optics 3 and the front face of a substrate 4 by predetermined within the limits may be used together.

[0056] For example, when a parent mask pattern is a high density pattern (periodic pattern), deformation illumination is adopted, and a light source configuration is specified to two or more partial fields to which only the equal distance separated from the optical axis of the shape of zona orbicularis, and an illumination-light study system mostly. Moreover, when a parent mask pattern contains only isolated patterns, such as a contact hole, while exposing the mask substrate by the pattern, it is good to adopt the so-called progressive focal method which moves the mask substrate in the direction in alignment with the optical axis of exposure optical system.

[0057] Moreover, the sigma value of an illumination-light study system may be set about to 0.1 to 0.4 by using a part of master reticle Ri for example, as a phase shift mask, and the above-mentioned progressive focal method may be adopted. Moreover, a photo mask may not be restricted to the mask which consists only of protection-from-light layers, such as chromium, and may be phase shift masks, such as a spatial-frequency modulation mold (Shibuya-Levenson mold), an edge enhancement mold, and a halftone mold. Especially, in the spatial-frequency modulation mold or the edge enhancement mold, in order to lay on top of the protection-from-light pattern on a mask substrate and to carry out patterning of the phase shifter, the parent mask for the location shifters will be prepared separately.

[0058] Next, the case where the image formation property of the projection image of the projection aligner which uses the working reticle 34 has separated from the ideal condition is explained. Supposing the projection aligner shown in drawing 6 which uses the working reticle 34 is an one-shot exposure mold, also when the nonrotation symmetry aberration of a certain extent or distortion remains, in the image formation property of the projection optics 42, it is possible. In such a case, while amending the scale factor of projection optics 3 so that it not only shifts an exposure location, but a corresponding scale-factor error may be offset in case the image of the master reticle Ri is exposed to the shot field Si on drawing 4 using the projection aligner of drawing 4 , the distortion property of projection optics 3 is also amended so that a partial corresponding distortion may be offset as much as possible. The distortion of the projection aligner which uses the working reticle 34 is offset by this, and superposition precision improves by it.

[0059] Next, supposing the projection aligner of drawing 7 is a scan exposure mold like step - and - scanning method, in the image formation property of the projection image, the so-called skew error from which an ideal image turns into a parallelogram-like projection image may remain. In this case, the projection aligner which manufactures the working reticle 34 should just also give distortion which offsets that skew error as step - and a - scanning method.

[0060] Next, it explains per example of actuation in the case of exposing using the working reticle 34 of drawing 1 manufactured as mentioned above. Drawing 6 shows the important section of the contraction projection mold aligner equipped with that working reticle 34, and Wafer W is arranged in this drawing 6 on the inferior surface of tongue of the working reticle 34 held on the reticle stage 49 through the projection optics 42 of contraction scale factor 1 / beta (beta is 5 or 4 grades). A photoresist is applied to the front face of Wafer W, and the front face is held so that it may agree in the image surface of projection optics 42. Wafer W is held on the sample base 43 through a non-illustrated wafer holder, and the sample base 43 is being fixed on X-Y stage 44. Based on the coordinate measured by migration mirror 45mX, 45mY, and the corresponding laser interferometer on the sample base 43, positioning of Wafer W is performed by driving X-Y stage 44.

[0061] Moreover, the reference mark member 46 by which reference marks 47A and 47B were

formed on the sample base 43 is fixed, and the alignment sensors 41A and 41B for the alignment of a reticle are arranged above the alignment marks 24A and 24B formed so that the pattern space 25 of the working reticle 34 might be inserted in the direction of X. Also in this case, alignment of the working reticle 34 is performed to the sample base 43 using reference marks 47A and 47B, the alignment marks 24A and 24B, and the alignment sensors 41A and 41B. Then, when performing superposition exposure, alignment of each shot field 48 on Wafer W is performed using the alignment sensor for non-illustrated wafers. And after positioning the shot field 48 for [on Wafer W] exposure in a sequential exposure location, image 27W which reduced the original edition pattern 27 in a pattern space 25 for 1/of contraction scale factors beta are exposed by the shot field 48 to the pattern space 25 of the working reticle 34 by irradiating the exposure light IL 1, such as excimer laser light, from a non-illustrated illumination-light study system. Thus, after exposing the contraction image of the original edition pattern 27 to each shot field on Wafer W, the circuit pattern of a certain layer of a semiconductor device is formed in each shot field on Wafer W by performing development of Wafer W and performing processes, such as etching.

[0062] In addition, as a projection aligner for exposure of the working reticle 34, the contraction projection mold aligner of a scan exposure mold like step - and - scanning method may be used. Next, other examples of the gestalt of operation of this invention are explained. With the gestalt of the above-mentioned operation, when a contraction image was projected on a substrate 4 with a projection aligner, this invention was applied, but in this example, in case the original edition pattern of a photo mask is drawn using an electron beam exposure system or laser beam drawing equipment, this invention is applied. In drawing 1 , when drawing the actual size image of the parent pattern Pi on the substrate of the master reticle Ri, it is used, but this is used, also when carrying out direct writing of the original edition pattern of a photo mask like before.

[0063] Drawing 9 shows the drawing equipment of this example, and sets it to this drawing 9 . For example, the substrate 55 (or the substrate of a working reticle is also good) of the master reticle Ri as a parent mask of drawing 1 A top face is laid in the top face of the convex substrate holder 51, and the substrate holder 51 is fixed on the sample base 56. The lock-pins 52A and 52B which energize caudad about two sides which a substrate 55 counters are formed on the sample base 56, and the substrate 55 is held so that a pattern formation side on top may serve as a convex in the upper part. The sample base 56 is movable in the two-dimensional direction on the base 58 by X-Y stage 57. The location of the sample base 56 is measured by 59m of migration mirrors, and the laser interferometer 59, and this measurement value is supplied to the control system 60 and the stage drive system 61. The stage drive system 61 drives X-Y stage 57 based on the measurement value and the positional information from a control system 60, and positions a substrate 55.

[0064] Which drawing system 62 of the drawing system which controls an exposure and cutoff of the drawing system which controls an exposure and cutoff of a laser beam LB, and draws a pattern, or electron beam EB, and draws a pattern is arranged above the substrate 55. A mask ingredient is formed on a substrate 55 and the photoresist or the electron beam resist is applied according to the laser beam LB or electron beam EB on this. And when a substrate 55 reaches a position to the drawing system 62, a control system 60 draws the pattern set up in the drawing field through the drawing system 62.

[0065] In this case, the deformation of the pattern side of a substrate 55 is set up similarly to the deformation to the lower part by the self-weight of the pattern side of that master reticle Ri at the time of loading the master reticle Ri which comes to form a pattern in that substrate 55 to the projection aligner of drawing 2 . When a contraction image is projected by this using the master reticle Ri, the position error of the contraction image etc. does not arise.

[0066] In addition, the maintenance device of the substrate of a photo mask may make the above-mentioned convex configuration and the almost same configuration by not being restricted to the gestalt of the gestalt of the above-mentioned operation, preparing a projection group in the contact surface with the substrate 4 of the substrate holder 51 in drawing 5 (B), and adjusting distribution of the die length of those projection groups. Moreover, with the gestalt of the above-mentioned implementation, although it shall press down near both the shorter sides of the substrate 4 of a photo mask more compulsorily than the upper part instead, both ends may be made to be caudad lowered using self-weight deformation of a substrate 4, and both ends may be caudad drawn near by vacuum

adsorption.
[0067] In addition, of course, configurations various in the range which this invention is not limited to the gestalt of above-mentioned operation, and does not deviate from the summary of this invention can be taken.
[0068]
[Effect of the Invention] Even if it is the case where self-weight deformation etc. arises in case the photo mask is used since the deformation produced at the time of the exposure to the substrate of a photo mask or drawing is doubled with the deformation condition at the time of using the photo mask according to the manufacture approach of the photo mask of this invention, there is an advantage which can maintain the location precision of the projection image of the photo mask good.

[0069] In the equipment which draws a photo mask by imprint exposure from a parent mask especially, although it had become an amending-the fall of pattern location precision by self-weight deformation technical problem, the fall of pattern location precision is completely cancelable with this invention. Moreover, the pattern to which the pattern for an imprint was expanded is divided into the pattern of two or more parent masks. On the substrate of the photo mask, in carrying out a sequential imprint, performing a screen splice, the contraction image of the pattern of two or more parent masks Since the patterns of two or more parent masks are some patterns which expanded the pattern for an imprint, for example, respectively, using an electron beam exposure system, laser beam drawing equipment, etc., it is little [respectively] drawing data, and they can be drawn in the small amount of drifts in a short time. Moreover, since the drawing error of a parent mask becomes small by the contraction scale-factor ratio of the pattern of the parent mask, it can form the pattern for an imprint (original edition pattern) with high precision. Furthermore, since it can be repeatedly used once it manufactures, those parent masks have the advantage which can form each original edition pattern in a short time with high precision, also when manufacturing several many sheets of the photo mask.
[0070] Moreover, according to the manufacturing installation of the photo mask of this invention, the manufacture approach of the photo mask of this invention can be enforced.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing with which explanation of the production process of the working reticle (photo mask) of an example of the gestalt of operation of this invention is presented.
[Drawing 2] It is the block diagram showing the optical contraction projection mold aligner used in case the working reticle is manufactured with an example of the gestalt of the operation.
[Drawing 3] In the projection aligner of drawing 2 , it is the perspective view of the important section which cut and lacked the part which shows the case where alignment of a master reticle is performed.
[Drawing 4] In the projection aligner of drawing 2 , it is the perspective view of an important section showing the case where the contraction image of the parent pattern of a master reticle is projected on a substrate 4.
[Drawing 5] The expansion top view in which (A) shows the maintenance condition of the substrate 4 of drawing 2 , and (B) are the enlarged drawings showing the maintenance condition of the substrate 4 of drawing 2 .
[Drawing 6] It is the perspective view showing the important section of the projection aligner which projects on a wafer the pattern of the working reticle manufactured with the gestalt of the operation.
[Drawing 7] It is the enlarged drawing showing the deformation condition of the working reticle laid in the projection aligner of drawing 6 .
[Drawing 8] It is drawing with which explanation of a location gap of the pattern by deformation of the working reticle is presented.
[Drawing 9] It is the block diagram showing the drawing equipment used in other examples of the gestalt of operation of this invention.
[Description of Notations]
R1-RN Master reticle (parent mask)
P1-PN Divided parent pattern
3 Projection Optics
4 Substrate for Working Reticles
S1-SN Shot field on a substrate 4
5 Sample Base
6 X-Y Stage
9 Main Control System
13A, 13B Reference mark
14A, 14B Alignment sensor for reticles
16 Reticle Library
18 Slide Equipment
19 Reticle Loader
21A, 21B Alignment mark of a master reticle
24A, 24B Alignment mark of a substrate
27 Original Edition Pattern
35 Circuit Pattern
36 Parent Pattern
51 Substrate Holder

52A, 52B Lock-pin

[Translation done.]

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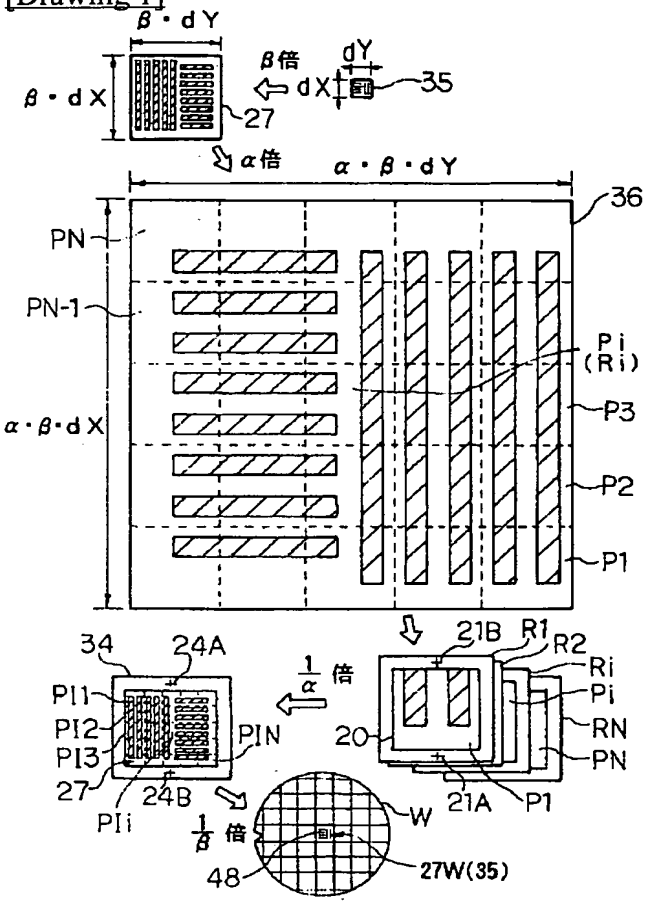
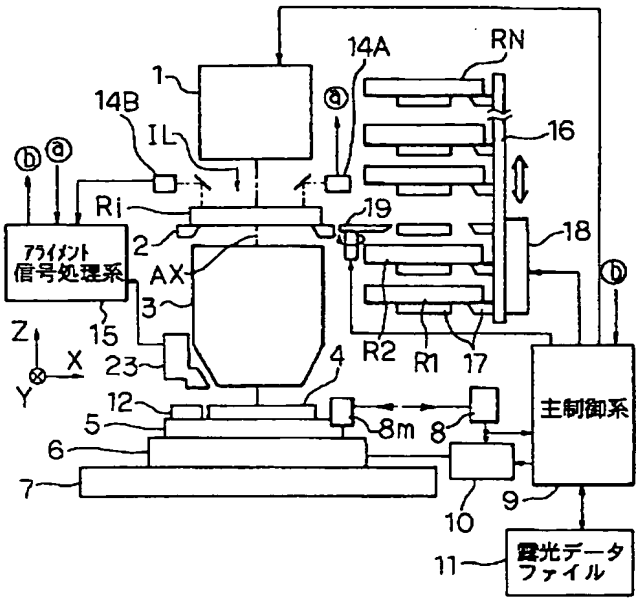
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

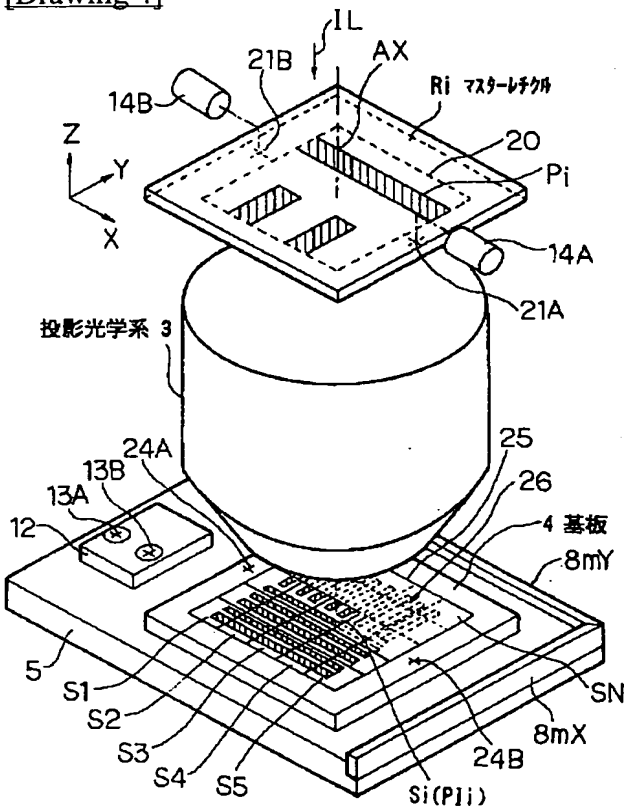
[Drawing 1]



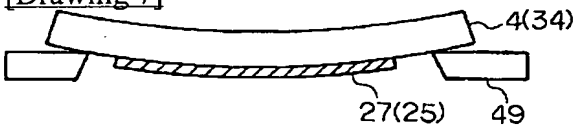
[Drawing 2]



[Drawing 4]



[Drawing 7]



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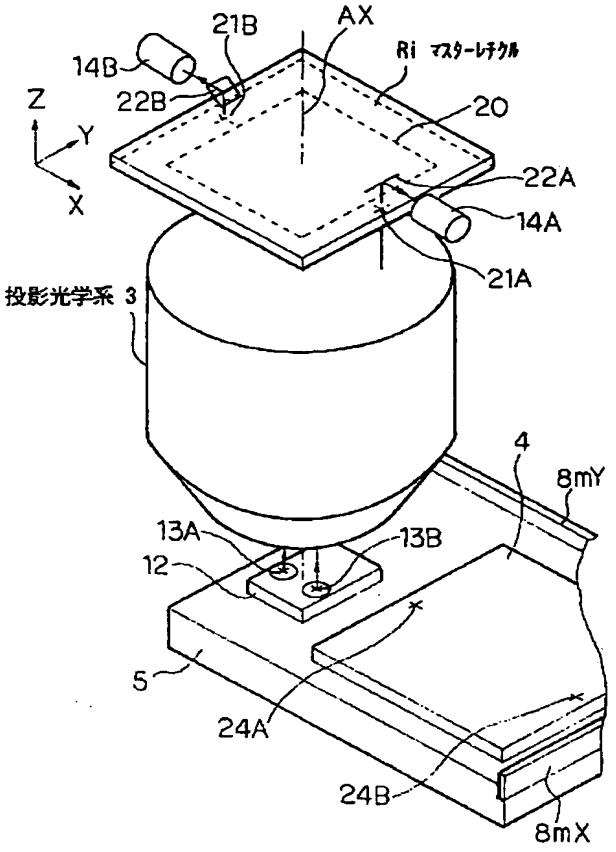
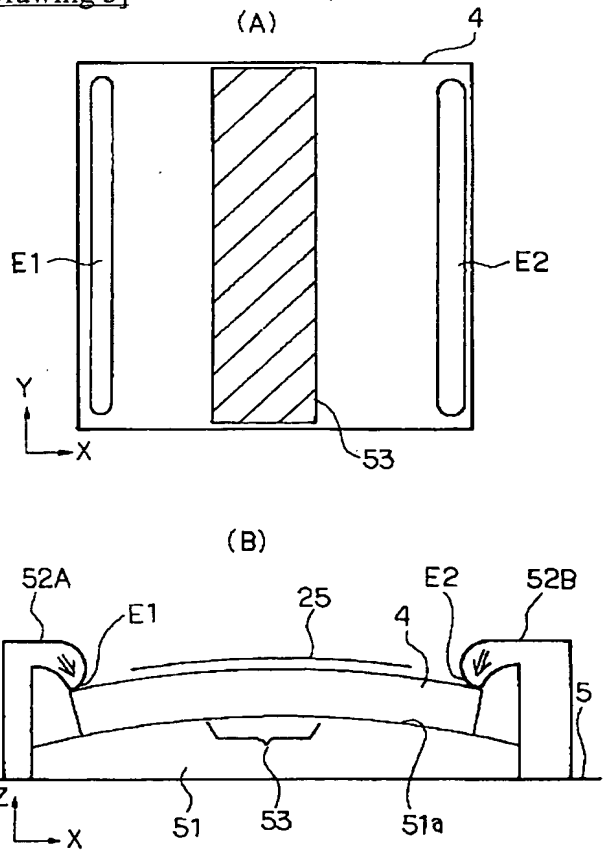
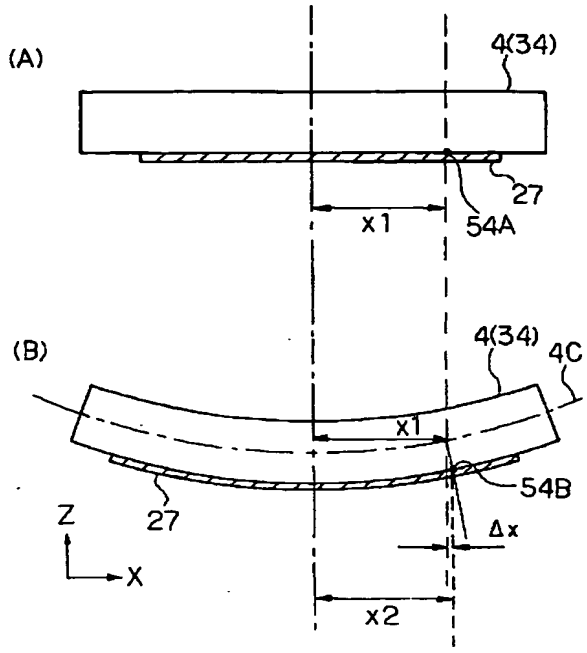


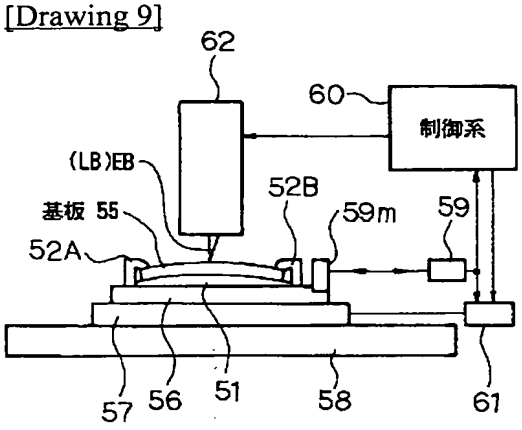
[Drawing 5]



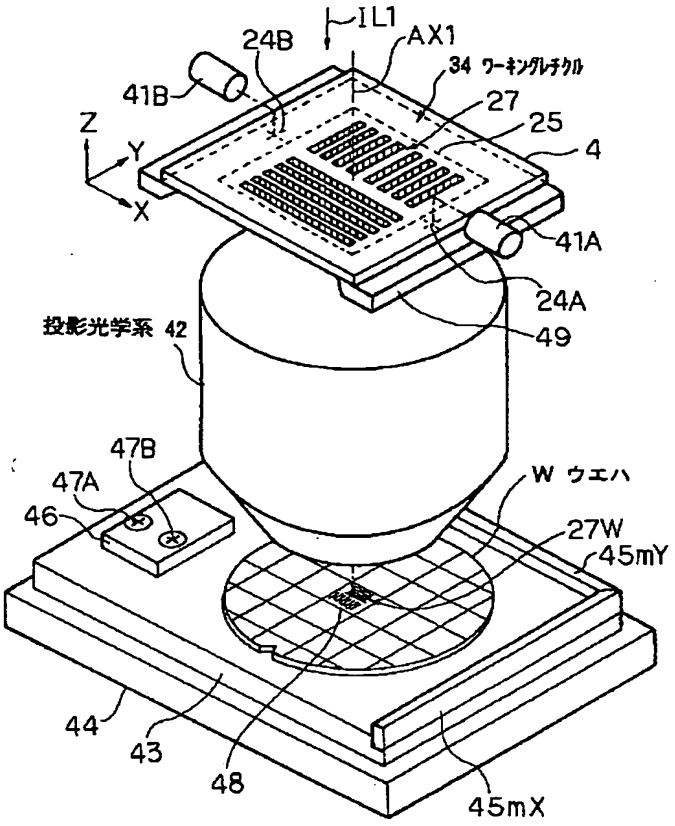
[Drawing 8]



[Drawing 9]



[Drawing 6]



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